APPENDIX 8-H. USER INSTRUCTIONS FOR THE LIFE-CYCLE COST ANALYSIS SPREADSHEET

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8-H.1 USER INSTRUCTIONS

The results obtained in this analysis can be examined and reproduced using the Microsoft Excel spreadsheets available on DOE's Heating Products Rulemaking website: http://www.eere.energy.gov/buildings/appliance_standards/. From that page, follow the links to the Final Rule phase and then to Analytical Tools.

8-H.2 STARTUP

DOE's spreadsheets enable users to perform Life-Cycle Cost (LCC) and Payback Period (PBP) analyses for each product class. A separate spreadsheet exists for each product class. Table 8-H.2.1 lists the LCC spreadsheets used in this rulemaking.

Table 8-H.2.1 List of LCC Spreadsheets

Filename	Product Class
LCC_WH_Gas(Storage).xls	Gas-Fired Storage Water Heaters
LCC_WH_Elec.xls	Electric Storage Water Heaters
LCC_WH_Oil.xls	Oil-Fired Storage Water Heaters
LCC_WH_Gas(Instantaneous).xls	Gas-Fired Instantaneous Water Heaters
LCC_PH.xls	Pool Heaters
LCC_DHE	Direct Heating Equipment

To examine the spreadsheets, DOE assumes that the user has access to a personal computer with a hardware configuration capable of running Windows NT/2000/XP. All LCC spreadsheets require Microsoft Excel 2003 or later installed under the Windows operating system. Because certain variables inside the spreadsheets are defined as distributions, the user's computer requires a copy of Crystal Ball (a commercially available add-on program) to view them.

8-H.3 DESCRIPTION OF LIFE-CYCLE COST WORKSHEETS

For each of the ten product classes, DOE created one spreadsheet containing a collection of worksheets. Each worksheet represents a conceptual component within the LCC calculation. To facilitate navigability and identify how worksheets are related, each worksheet contains an area on the extreme left showing variables imported to and exported from the current worksheet. Each LCC spreadsheet contains the following worksheets:

Summary The *Summary* worksheet contains a user interface to manipulate energy price trend and start year inputs, and to run the Crystal Ball simulation. LCC and PBP simulation results for each design option are also displayed here.

Statistics The *Statistics* worksheet contains statistics of the results for each design

option.

LCC&PB Calcs The *LCC&PB Calcs* worksheet shows LCC calculation results for different efficiency levels for a single Residential Energy Consumption Survey (RECS) household.[1] During a Crystal Ball simulation, the spreadsheet records the LCC and PBP values for every sampled household.

Rebuttable Payback The *Rebuttable Payback* worksheet contains the total and incremental manufacturer costs, retail prices, the installation costs, the repair and maintenance costs, energy use calculations, and the simple payback period calculations for each efficiency level. DOE water heater, pool heater, or DHE test procedures are used to calculate parameters used in energy use calculations.

Equip Price The *Equip Price* worksheet calculates retail price values used as inputs in the LCC calculations in the *Summary* worksheet. DOE applied baseline and incremental markups to calculate final retail prices. DOE calculated the markups differently for replacement units and new units.

Models Data The *Models Data* worksheet determines characteristics of the water heater, direct heating equipment, and pool heater products used in the analysis.

Energy Use The *Energy Use* worksheet calculates annual energy use by fuel type, depending on product class. The annual energy use calculations for each design option are inputs to the *LCC&PB Calcs* worksheet to calculate the annual operating cost of the LCC. For gas-fired storage, electric, and oil-fired water heater spreadsheets, this worksheet contains efficiency equation table calculations for the coefficients for each efficiency level.

RECS HH Data The *RECS HH Data* worksheet contains the RECS 2005 household data for each product class. During a Crystal Ball simulation, DOE uses these household characteristics to determine the location of the water heater, the operating temperatures, house heating load, annual gas or oil use, size of the house, age of the house, and the age of the existing heating products.

Base Case EF The *Base Case EF* worksheet determines the efficiency of the base case unit.

Installation Cost The *Installation Cost* worksheet provides the weighted average installation cost for each design option. These results are used to calculate the total installed prices of the design options.

Maintenance and The *Maintenance and Repair Cost* worksheet provides the maintenance

Repair Cost and repair costs for each design option. These results are used to determine operating costs for the design options.

Energy Price Trends The *Energy Price Trends* worksheet shows the future price trends of the different heating fuels. DOE used energy price data and forecasts from the EIA's Annual Energy Outlook 2010 for the period until 2030, and extrapolated beyond 2030.[2]

Discount Rate The *Discount Rate* worksheet contains the distributions of discount rates for replacement and new units.

Lifetime The *Lifetime* worksheet contains the distribution of lifetimes for equipment of that product class.

NIA Inputs The *NIA Inputs* worksheet contains intermediate inputs used for other DOE analyses.

8-H.4 BASIC INSTRUCTIONS FOR OPERATING THE LIFE-CYCLE COST SPREADSHEETS

Basic instructions for operating the LCC spreadsheet are as follows:

1. Once the LCC spreadsheet has been downloaded, open the file using Excel. Click "Enable Macro" when prompted and then click on the tab for the *Summary* worksheet.

2. Use Excel's View/Zoom commands at the top menu bar to change the size of the display to fit your monitor.

3. The user can change the parameters listed under USER OPTIONS on the *Summary* worksheet. There are three drop-down boxes and one command button. The default parameters are:

    a. Energy Price Trend: Defaults to "AEO 2010 - Reference Case (Early Release)." To change the input, use the drop-down menu and select the desired trend (Reference, Low, or High).

    b. Start Year: Defaults to "2015." To change the value, use the drop-down menu and select the desired year.

    c. # of Trials: Defaults to "10,000." To change the value, use the drop-down menu and select the desired number of trials (1,000, 2,000, 3,000, 5,000, or 10,000).

    d. Subgroup: Defaults to "National." To change the sample used for LCC and PBP calculations, use the drop-down menu and select the desired subgroup from the available samples (National, Low-Income, Senior-Only, Multi-Family,

Manufactured Home, Small-Volume Water Heaters, and Large-Volume Water Heaters).

4. To run the Crystal Ball simulation, click the "run" button (you must re-run after changing any parameters). The spreadsheet will then be minimized. You can monitor the progress of the simulation by watching the count of iterations at the left bottom corner. When the simulation is finished, the worksheet named *Summary* will reappear with the results.

5. Additional information can be found in the *Statistics* worksheet.

REFERENCES

1. U.S. Department of Energy - Energy Information Administration, *Residential Energy Consumption Survey: 2005 Public Use Data Files,* 2005. <http://www.eia.doe.gov/emeu/recs/recspubuse05/pubuse05.html>

2. Energy Information Administration, *Annual Energy Outlook 2010 (Early Release) with Projections to 2035*, 2010. Washington, DC. Report No. DOE/EIA-0383(2010). <http://www.eia.doe.gov/oiaf/aeo/>